INDOOR AIR QUALITY ASSESSMENT

Department of Transitional Assistance
72-100 Front Street
Holyoke, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
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Background/Introduction

On March 18, 2005, the Massachusetts Department of Public Health's (MDPH), Center for Environmental Health (CEH), provided assistance and consultation regarding indoor air quality concerns at the Department of Transitional Assistance (DTA), located at 72-100 Front Street, Holyoke, MA. The request was prompted by indoor air quality symptoms (e.g., headaches, runny nose, cough, eye and respiratory irritation and headaches) reported by occupants. The indoor air quality assessment was conducted by Cory Holmes, an Environmental Analyst in CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program. Mr. Holmes was accompanied by Carlene Renaud, DTA Director, Holyoke office.

The DTA occupies the second floor of what is known as the Lyman Mill Building, a seven-story tower and a three-story building. The Lyman Mill Building was built in 1850 as a textile manufacturing plant. The building operated from 1964 to 1986 as a warehouse for paper supplies. In 1986 the building underwent renovations to convert the warehouse to office space. The DTA has occupied the building since 1988.

Methods

MDPH staff conducted air tests for carbon dioxide, temperature and relative humidity with the TSI, Q-Trak, IAQ Monitor, Model 8551. MDPH staff also performed a visual inspection of building materials for water damage and/or microbial growth.

Results

The DTA has an employee population of approximately 60 and can be visited by up to 70 individuals daily. The tests were taken during normal operations. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were below 800 ppm (parts per million) in all areas surveyed, indicating adequate ventilation. A heating, ventilating and air conditioning (HVAC) system, which consists of rooftop air handling units (AHUs) ducted to ceiling-mounted supply and return vents (Pictures 1 and 2). This system was operating throughout the building on the day of the assessment.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room, while removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years (SMACNA, 1994). The date of the last balancing was not available at the time of the assessment, however Ms. Renaud mentioned that the property manager's HVAC engineer had made adjustments and repairs to the ventilation system and that thermostats were recalibrated several weeks prior to the MDPH assessment.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or

openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see Appendix A.

Temperature readings ranged from 71° F to 76 ° F, which were within the MDPH recommended comfort guidelines the day of the assessment. The MDPH recommends that indoor air temperatures be maintained in a range of 70 ° F to 78 ° F in order to provide for

the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply. In work location 246, a ceiling-mounted supply diffuser was stuffed with paper towels and deflected with cardboard and tape (Picture 3), reportedly to control drafts. This alteration, however, can throw the ventilation system off-balance and create uneven heating/cooling conditions in other areas adjacent to the blocked diffuser.

The relative humidity measurements in the building ranged from 18 to 22 percent, which were below the MDPH recommended comfort range the day of the assessment. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

A few areas had water damaged ceiling tiles (Picture 4). Water damaged ceiling tiles can provide a source of mold and should be replaced after a moisture source or leak is discovered and repaired. Water coolers were observed on carpeting (Picture 5). Water spillage or overflow of cooler catch basins can result in the wetting of the carpet. In addition, some of the coolers had residue/build-up in the reservoir. These reservoirs are designed to catch excess water during operation and should be emptied/cleaned regularly to prevent microbial and/or bacterial growth.

The US Environmental Protection Agency and the American Conference of Governmental Industrial Hygienists (ACGIH) recommends that porous materials (carpeting, ceiling tiles, etc.) be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If porous materials are not dried within this time frame, mold growth may occur. Water-damaged porous materials cannot be adequately cleaned to remove mold growth. The application of a mildewcide to moldy porous materials is not recommended.

Several areas contained a number of plants. Plants, soil and drip pans can serve as sources of mold growth, and thus should be properly maintained. Plants should have drip pans to prevent wetting and subsequent mold colonization of window frames. Plants should also be located away from ventilation sources to prevent aerosolization of dirt, pollen or mold.

Other Concerns

Several other conditions that can potentially affect indoor air quality were identified. A number of areas contained photocopiers. Volatile organic compounds (VOCs) and ozone can be produced by photocopiers, particularly if the equipment is older and in frequent use. VOCs are materials, which evaporate readily and can be irritating to eyes, nose and throat. Ozone is a respiratory irritant (Schmidt Etkin, 1992). Occupants should ensure local exhaust ventilation is operating near photocopiers to remove/reduce excess heat and odors.

A number of supply and return/exhaust vents had accumulated dust (Pictures 6 and 7). If exhaust vents are not functioning, backdrafting can occur, which can aerosolize dust

particles. In addition, these materials can accumulate on flat surfaces (e.g., desktops, shelving and carpets) in occupied areas and subsequently be re-aerosolized causing further irritation. Dust can be irritating to eyes, nose and respiratory tract.

Finally, mechanical exhaust ventilation was not functioning in the men's restroom during the assessment. Exhaust ventilation is necessary in restrooms to remove moisture and to prevent restroom odors from penetrating into adjacent areas.

Conclusions/Recommendations

In view of the findings at the time of the visit, the following recommendations are made:

1. Repair/replace restroom exhaust motors as necessary.
2. Remove all obstructions from supply vents.
3. Ventilation industrial standards recommend that mechanical ventilation systems be balanced every five years (SMACNA, 1994).
4. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (e.g. throat and sinus irritations).

5. Ensure water leaks are repaired and replace water damaged ceiling tiles. Examine the non-porous surface beneath the removed ceiling tiles and disinfect with an appropriate antimicrobial.
6. Ensure plants have drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary.
7. Relocate or place tile or rubber matting underneath water coolers in carpeted areas. Clean and disinfect reservoirs as needed to prevent microbial growth.
8. Clean supply/return vents periodically of accumulated dust.
9. For further building-wide evaluations and advice on maintaining public buildings, see the resource manual and other related indoor air quality documents located on the MDPH's website at http://www.state.ma.us/dph/beha/iaq/iaqhome.htm.

References

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Picture 1

Ceiling-Mounted Supply Diffuser

Picture 2

Ceiling-Mounted Return Vent

Picture 3

Supply Air Diffuser Stuffed with Paper Towels and Deflected with Cardboard and Tape

Picture 4

Water Damaged Ceiling Tiles

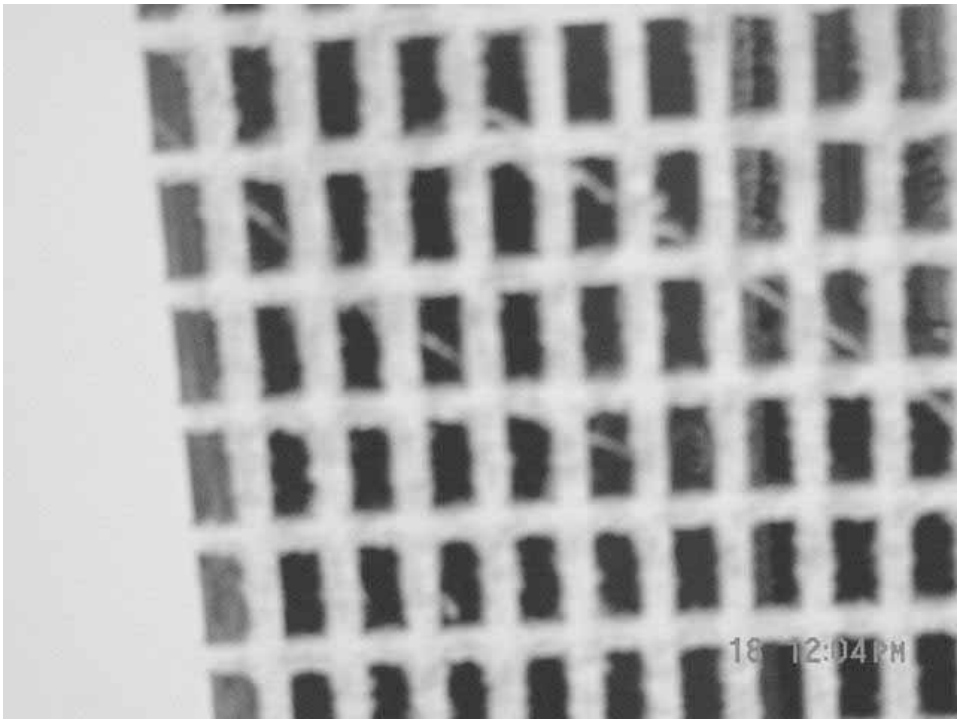
Picture 5

Water Cooler on Carpeting

Picture 6

Dust/Dirt Accumulation on Supply Air Diffuser

Picture 7



Dust/Dirt Accumulation on Return/Exhaust Vent

TABLE 1

Indoor Air Test Results – Holyoke Dept. Transitional Assistance March 18, 2005

Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
Outside (Background)	405	65	13					Atmospheric Conditions: Mostly sunny, NW winds 10-15 mph, moderate traffic
Renaud Office	762	71	22	2	N	Y	Y	
276	794	73	21	8	N	Y	Y	Plants
246	758	73	20	0	N	Y	Y	Supply diffuser stuffed with paper towels
280	756	73	20	4	N	Y	Y	
239	760	73	20	3	N	Y	Y	3 water damaged ceiling tiles
235	768	73	19	3	N	Y	Y	Plants
230	766	73	19	1	N	Y	Y	1 water damaged ceiling tile
263	784	74	19	2	N	Y	Y	
261	770	74	19	4	N	Y	Y	

*** ppm = parts per million parts of air**

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

Table 1-1

TABLE 1

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Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
259	768	75	19	3	N	Y	Y	
270	783	75	20	2	N	Y	Y	
272	772	75	19	0	N	Y	Y	
Mullen Office	761	75	18	1	N	Y	Y	
252	757	76	19	1	N	Y	Y	
Men's restroom					N	Y	Y	Exhaust-no draw
209	760	75	18	2	N	Y	Y	
212	734	75	18	2	N	Y	Y	
Reception	792	75	19	3	N	Y	Y	
I.D. Room	789	76	19	1	N	Y	Y	

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Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
214	767	76	18	2	N	Y	Y	Photocopiers
221	761	75	18	2	N	Y	Y	1 water damaged ceiling tile
225	756	74	18	0	N	Y	Y	
224	750	74	18	1	N	Y	Y	Plants
Kelly	754	74	18	0	N	Y	Y	
Women's restroom					N	Y	Y	
DV Office	730	75	18	0	N	Y	Y	
Appeals Room	706	75	18	0	N	Y	Y	

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